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A SMALL INEXPENSIVE STIRRER FOR  
PROMOTING CIRCULATION OF WATER OR AIR

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### Description and Use

This is an easily made stirrer which can be used in a small water bath or for producing a slight circulation of air in a small controlled-temperature chamber. It was designed and constructed at the U. S. Entomological Laboratory at Puyallup, Wash. It produces satisfactory circulation in a 10-gallon water bath to keep the temperature uniform throughout the tank. By substituting a fan about 8 inches across, it should produce a sufficient circulation of air in a chamber as large as one or two cubic yards to maintain a uniform temperature or humidity. When used for this purpose, it should be mounted outside the chamber, with the shaft projecting through the wall, since the motor runs quite warm.

The motor used is a two-pole, uni-directional geared-head Barcol midget motor No. KYAz-2575 of about .0020 horsepower, with a 29.5-to-1 gear reduction, reducing the speed from 3,200 to about 109 revolutions per minute. It is a 110-volt, alternating-current, single-phase induction motor of the shaded pole type, so it has no brushes or commutator to bother and has only one moving part, the squirrel-cage rotor, which runs on oilless bronze and graphite bearings, hence can be used for continuous operation with very little attention. The motor cost \$2.65, including postage. The other parts of the stirrer were made from odds and ends and cost very little. With the exception of cutting the grooves in the bakelite pulleys, the outfit can be constructed with the use of ordinary tools. The pulleys were turned at this laboratory by holding them with a bolt in a drill chuck attached to a small motor. A sharpened file served as a cutting tool.

### Details of Construction

Each wire of one end of a drop cord was passed through the hole and soldered to one of the inserts on the ends of the field coil of the motor, using rosin flux for soldering. The motor was then mounted on a base consisting of a piece of 18-gauge galvanized iron 3 by 6 inches in size, with the bolt holes 2 inches from one end (fig. 1). Round-head brass machine screws (size 10, 32 threads, 1/4 inch) were used for securing the motor (fig. 3). A 15/32 inch hole was drilled in the center of the base about 2 inches from the other end to accommodate a valve stem from an automobile tire, as shown in figures 1 and 3. The hole in the valve stem was drilled to 3/16 of an inch to serve as a bearing for the stirrer shaft, which was made from a 12 inch piece of 3/16 inch bronze brazing

rod carefully polished down with fine emery cloth until it just passed through the valve stem without binding. A brass wire connector, obtainable from any dealer in electrical supplies, was cut in two, and the holes were enlarged to  $3/16$  of an inch to serve as hubs for the stirrer and driven pulley. The stirrer blades were cut in one piece from a disk of brass  $2-3/4$  inches in diameter and  $1/64$  inch in thickness, soldered to the hub, and the blades twisted to an angle of about  $22^\circ$ . The drive and driven pulleys were made from  $3/16$  inch bakelite, diameters  $1-3/16$  and  $1-5/8$  inches, respectively, and each has a V groove  $3/32$  inch deep and  $1/8$  inch wide for the belt. The small, or drive, pulley has a  $21/64$  inch hole, or one just large enough so that it can be forced over the cogs on the second pinion of the motor (fig. 1).

The large gear was removed for this setup and the small pulley attached to the pinion of the second gear, which gave a speed of about 250 r.p.m. for the stirrer blade. Where there is room for a larger blade on the stirrer, the pulley could be attached to the large gear, in which case it should be as large as the pulley on the stirrer shaft and would then turn at approximately 109 r.p.m. without load.

One fourth inch of the end of the piece of brass wire connector for the hub of the large pulley was turned to  $5/16$  inch and a 1 inch brass disk with a  $5/16$  inch hole in the center was slipped over it and soldered to the shoulder. Two  $9/64$  inch holes were drilled near the opposite edges of the disk. The large pulley was made with a  $5/16$  inch hole, also, and was slipped over the turned end of the hub, two  $1/8$  inch holes were drilled to match the ones in the disk, and a round-head brass machine screw (size 6, 32 threads,  $3/16$  inch) was forced into each hole, cutting its own threads, to hold the pulley to the disk, as shown in figures 1 and 2. It would not be necessary to turn the end of the hub down, for it could be filed smooth and at exactly a right angle to the hole and the brass disk, with a  $3/16$  inch hole, soldered to the end of the hub with the holes in line. In this case a  $3/16$  inch hole should be drilled in the center of the pulley. The pulley could then be attached to the disk by means of the two screws, as described above.

The other end of the hub should also be filed smooth and square, for it acts as a bearing surface working on top of the valve stem. Brass screws are used in the hubs of the stirrer and large pulley so that they will not rust or cut the shaft. The coil spring belt should be stretched just enough to leave the coils slightly open when released and should be cut so as to be just tight enough to turn the stirrer without slipping. The depth of the stirrer blades in the water bath may be varied by sliding the shaft up or down through the large pulley and holding it at the proper height by means of the set screw in this pulley. The assembled outfit is shown in figures 3 and 4. In use, the base of the stirrer rests on the cover of the water bath, with the shaft and end of the valve stem extending down through the hole. A small box is inverted over the outfit to protect it from dust and damage.

List of Materials

- 1 Barcol geared-head midget motor No. KYAz-2575, gear reduction 29.5 to 1
- 4 brass machine screws, size 10, 32 threads,  $\frac{1}{4}$  inch
- 2 brass machine screws, size 6, 32 threads,  $\frac{3}{8}$  inch
- 2  $\frac{1}{4}$ -inch iron washers
- 1 piece 18-gage galvanized iron 3 by 6 inches
- 1 piece  $\frac{3}{16}$  inch bakelite about 2 inches square
- 1 piece  $\frac{3}{16}$  inch bakelite about 1 inch square
- 1 piece sheet brass about  $\frac{1}{64}$  inch thick and 3 inches square
- 1 piece sheet brass about  $\frac{1}{64}$  inch thick and 1 inch square
- 1 Bryant no. 202 brass wire connector, 2 screw, size  $1\frac{3}{4}$  inches by  $\frac{3}{8}$  inch, with a .185 inch hole for no. 4 solid wire
- 1 automobile tire inner tube valve stem, with two nuts for same
- 1 piece  $\frac{3}{16}$  inch bronze brazing rod, 12 inches long (or may be any length to suit location of stirrer blade)
- 1 length drop cord to connect motor to electrical outlet
- 1 electric plug to fit outlet
- 1 coil spring belt about  $\frac{5}{64}$  inch in diameter and 10 inches in length, of type used on 16 mm cine cameras



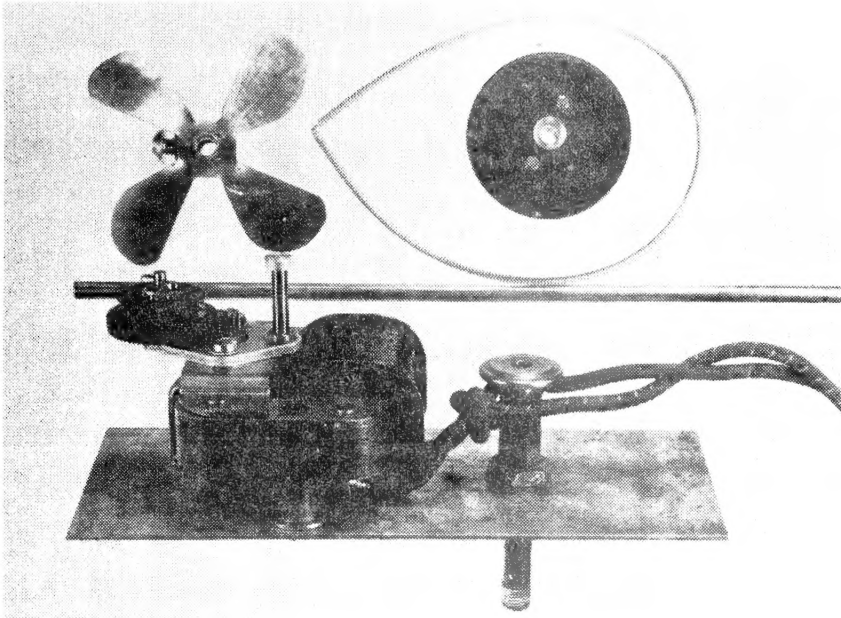


Figure 1.--Midget motor and valve stem mounted on galvanized-iron base. The large gear was removed from the motor, and the small bakelite pulley is shown pressed over the cogs on the pinion of the small spur gear. At the top is shown the four-blade stirrer, pulley, belt, and shaft.

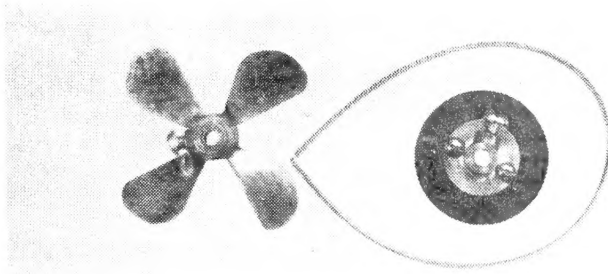


Figure 2.--Stirrer blade and large pulley from below, showing details of attachment to the hubs.





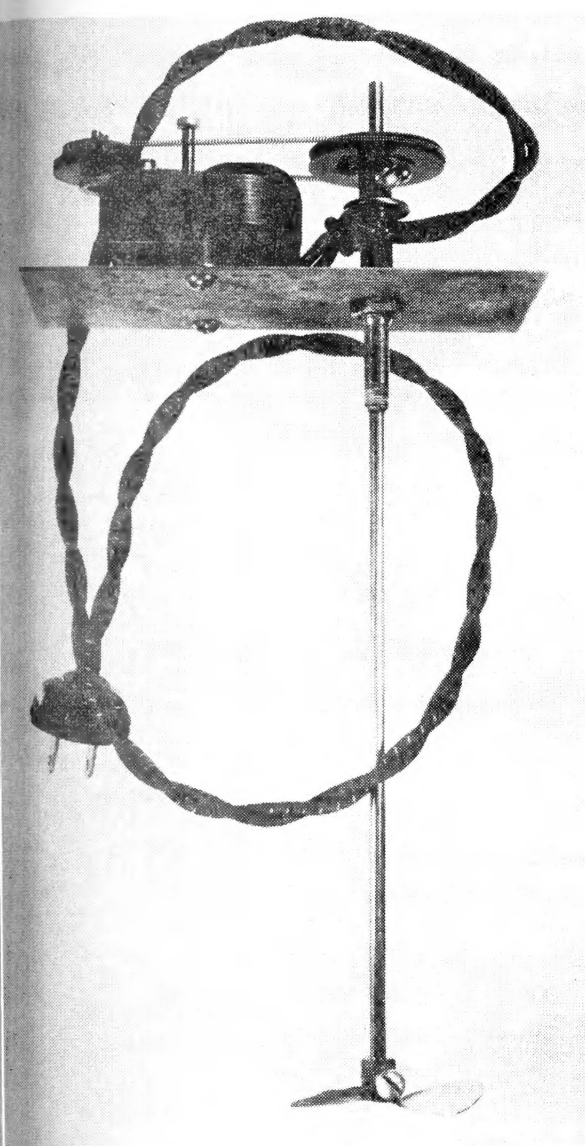


Figure 3.--View of assembled stirrer from side, showing large pulley, shaft, and stirrer blade in place and further details of the valve-stem bearing.

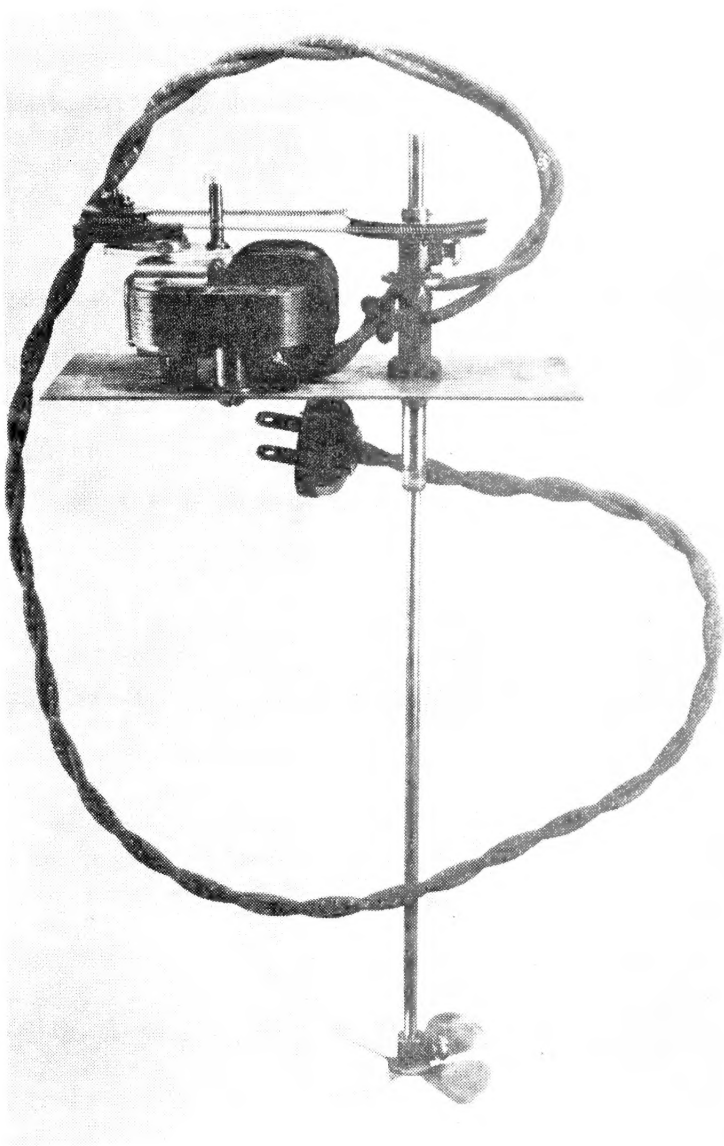


Figure 4.--View from above of assembled inexpensive stirrer for small water bath.

